53 (EC 714) DIPR

2018

DIGITAL IMAGE PROCESSING

Paper : EC 714

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* State the applications of image processing in the field of medical science. 5

   (b) Describe briefly the utility of the following image processing tasks : 5×2

   (i) Image enhancement

   (ii) Image segmentation

   (iii) Image registration

(iv) Image compression

(v) Feature extraction.

(c) Explain briefly with diagram, how a color image is formed with a digital camera. 5

2. (a) Write mathematical equation of I-D convolution and cross-correlation. How can they be related ? 2+2+2

(b) A sequence $x(n) = [1\underset{\uparrow}{2}0\,3]$ is convolved with $y(n) = [2\underset{\uparrow}{0}3\,4]$. Find convolution and correlation between them. 4+4

(c) An image of size 128×128 is convolved with a 5×5 kernel. What will be the size of the image after convolution ? 2

(d) Write the generalised expression of 2D image transform. Explain its complexity. Discuss how the complexities can be reduced using separability of the kernel. 1+3

3. (a) Perform ID FFT and find $x(0)$, $x(1)$, $x(4)$, $x(5)$ for the following sequence : 4×2

$$x(n) = [1\,0\,2\,3\,0\,2\,1\,4].$$

(b) Define 8×8 kernel of W-H transform when 2×2 kernel is given :

$$H_2 = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$$

using this 2×2 kernel perform 2D image transform of $x(n) = \begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix}$.

Hint : $F = f.H.f^T$ 2+3

(c) Write down the forward and inverse kernel for the following transformation for 2D image transform : 2+2

(i) DCT

(ii) DHT

(d) Discuss benefits of DCT over other transformations. 3

4. *(a)* State the differences between spatial and intensity transformation. Explain with suitable examples. 3

(b) A gray level 3-bit image historgram is given below :

Gray level :	0	1	2	3	4	5	6	7
Frequency :	400	700	1350	2500	3000	1500	550	0

Apply histogram equalization technique and find out the kernel histogram after equalization. 8

(c) Frame a suitable mask for the following image operation : 2+2+3+2

(i) $\frac{\partial^2 f(x,y)}{\partial x.\partial y}$

(ii) $\frac{\partial^2 f(x,y)}{\partial x^2} + \frac{\partial^2 f(x,y)}{\partial y^2}$

(iii) An edge enhancer

(iv) A low pass filter.

5. *(a)* What is motion blur ? Mathematically model motion blur and derive its degradation function. 2+8

(b) Is it possible to use winner filter for reconstructing blurred image ? Explain how the transfer function of that filter is derived. 1+9

6. *(a)* Differentiate between lossless and lossy image compression techniques. 3

(b) Match the following : 5×1

(i)	MPEG-4	Fax
(ii)	JPEG	DCT
(iii)	Run-length coding	Lossless coding
(iv)	Huffman coding	Video coding standard
(v)	Predictive coding	DPCM

(c) Why DCT is preferrable over DFT in image compression ? State different steps with block diagram for JPEG image compression technique. 2+10

7. Write short notes on : ***(any two)*** 10×2

(a) K–L transform

(b) Homomorphic filtering

(c) Run-length coding

(d) Histogram specification.
